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Editorial

Obstructive symptoms in athletes: is it asthma and what to do about it?

Asthma symptoms recorded as wheezing, abnormal breathlessness or cough induced by exercise are commonly reported among top athletes. In recent years, asthma has been defined by a combination of clinical and pathological criteria, with the latter being characterized by a chronic inflammation in the bronchial mucosa, including the activation of eosinophils, lymphocytes and endothelial cells. In the clinical setting, asthma is characterized by increased bronchial responsiveness to various stimuli, resulting in variable bronchial obstruction. Whether the obstructive symptoms reported by top performing athletes are due to the presence of airway inflammation, or should be considered as a normal physiological response to an extreme exposure is under debate.

The prevalence of asthma in athletes has been reported in a number of papers. These figures vary considerably. About 9% of Australian olympic athletes in 1976 and 1980, with a predominance of swimmers, reported asthma (1). In the U.S. olympic team in Los Angeles 1984, 4·4% had self-reported disease (2), while 3·7% of 2060 Swiss athletes reported the disease in a questionnaire study (3). A higher prevalence of exercise-induced asthma (EIA) was reported in both populations: 11·2% in the U.S. team and 7·1% in the Swiss athletes. Neither of these reports included a control population. The highest prevalence of questionnaire-reported asthma has been found in cross-country skiers. A past or present history of asthma was reported by 14% of skiers and 5% of controls in Norway (4), while the corresponding figures in a Swedish study were 15 and 6% respectively (5).

There are few reports on provocation tests in athletes. New athletes at the University of Washington 1979–1981 were screened for EIA using a structured interview. Symptomatic individuals were subjected to an exercise test and 2·8% were found to have EIA (6). Methacholine provocation was performed in 151 American football players. A high proportion (50%) were found to have bronchial hyper-responsiveness but this also was the case in 41% of the students used as controls and 25% of basketball players (7). In a study of 42 Swedish élite cross-country skiers, 38% were hyper-reactive to methacholine compared to 7% of the 29 controls; an additional 21% (n=9) had been previously diagnosed with asthma and used inhaled steroids but were not hyper-reactive at the time of the survey (8).

It can be concluded that presently there are not, to our knowledge, any convincing data supporting the assumption that asthma is more common in athletes other than cross-country skiers. Even though bronchial hyper-responsiveness and asthma symptoms seem to be more common in cross-country skiers, it has still to be established whether 'skiers' asthma' represents a separate entity, or can be synonymous with the morphologically-defined asthma in a broader sense. Exercise and cold air exposure are well known trigger factors in susceptible individuals, and most asthmatics report symptoms from physical exercise (9,10). Whether cold air exposure may itself induce an inflammatory response or only act as a trigger factor on susceptible individuals is still an open question. A transient increase in bronchial responsiveness by inhalation of cold and dry air has been reported in asthmatic (11) as well as in healthy (12) individuals. A late obstructive response after exercise test is occasionally seen in individuals with asthma, indicating that inflammation may be induced by exercise — at least in some individuals (13). A transient increase in the number of eosinophils and eosinophilic cationic protein (ECP) (14), as well as a raised serum level of histamine (15), has been reported after exercise in asthmatics. Moreover the antihistamine, terfenadine, has been shown to partly inhibit the obstructive response induced by hyperventilation with cold air, indicating that mast cells may be pathophysiologically involved (16). Thus, it seems reasonable to assume that inflammation is a substantial part of EIA. The findings of an increased rate of bronchial hyper-reactivity among cross-country skiers suggests that the high prevalence of airway symptoms is due to airway inflammation in this group. As these findings indicate that persistent inflammation may be induced by cold and dry air (8), the nature of the changes in skiers needs to be studied more carefully, preferably with invasive techniques,

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i.e. bronchoscopy. If the changes in 'skiers' asthma' correspond to those in asthma in other individuals, it seems probable that cold and dry air are not only asthma triggers, but also possible asthma inducers. The results presented by Sue-Chu *et al.* support the assumption that the climate influences the symptoms in skiers (17).

A dry inland climate has, in population studies, been shown to be associated with more asthma symptoms compared to humid coastal climates in Sweden (18), and warmer climates in Saudi Arabia (19). This indicates that airway drying may be as important as airway cooling *per se*. This is in accordance with results reported by Bar-Or *et al.* (20) and by Anderson *et al.* (21), while others advocate cold as the principle hazard factor (22).

It seems reasonable to believe that the small differences observed in the general population, possibly due to climate factors, may be considerably larger in a population that expose themselves to the climate in an extreme way during cross-country skiing. This underlines the importance of a multifactorial approach to asthma when considering why asthma seems to be an increasing problem in the industrialized world.

As the causes of asthma in athletes seems to be multifactorial, the treatment and especially preventive measurements, should be multifactorial. We suggest that the presence of asthma symptoms in combination with bronchial hyper-responsiveness or the presence of exercise-induced obstructive response should, until we know more, be handled and treated in line with general asthma management, as we know it today. This means a combined use of anti-inflammatory drugs, preferably inhaled steroids, and bronchodilators taken as rescue medication and before exercise. It should be noted that the use of long acting β_2-agonists is banned as doping by the IOC (International Olympic Committee) and should therefore not be used by competitive athletes. β_2-agonist treatment may enhance muscle strength in experimental settings (23). In practice, however, it has been impossible to show any effects of β_2-agonist treatment which support the theory of β_2-agonist as a doping agent. On the contrary, β_2-agonist treatment has been shown to increase ventilation–perfusion mismatching in asthmatics (24). This negative effect of β_2-agonist treatment seems to be balanced by the increased ventilatory capacity caused by bronchodilatation. In healthy individuals, neither of these responses occurred, and no positive net effect on performance was seen in healthy endurance athletes by salbutamol (25, 26) nor by 3 mg of inhaled terbutaline when tested in cold chamber (unpubl. data). The use of disodium chromoglycate (DSCG) or nedocromile before exercise is an alternative preventive measure which is usually somewhat less effective, but the combination of DSCG with β_2-agonist treatment can act synergistically (27–29).

However, it needs to be stressed that medication alone should not be regarded as the solution for asthma problems in athletes. It is essential to minimize the exposure to other risk factors, for example training/competition close to a respiratory tract infection. Some viral infections (e.g. RSV, adenovirus, para-influenza etc.) have been shown to cause a prolonged bronchial hyper-responsiveness in susceptible individuals. It is not known how long athletes should refrain from training after recovering from an infection, but the 'safe' time is probably more than 1 week. It is also probable that the present temperature limit in cross-country skiing (-20°C in international competitions) is far too low. We suggest that the temperature limit should not decrease below -15°C, and for young individuals, this limit should be even higher. It is also important to stress the use of heat exchangers in training and warming-up. This equipment not only raises temperature, but also humidifies inspired air.

A careful warm-up is also mandatory for reducing the problems with exercise-induced obstruction. The individuals should be instructed to start warm-up not less than 45 min before competition. The warm-up sequence should be individualized, but include events of sub-maximal or close to maximal periods, with the purpose of inducing refractoriness against later obstructive responses (30).

In summary, it can be concluded that asthma is seen more frequently in cross-country skiing athletes than control subjects, while the pattern in other sports is unclear. The exposure to cold and dry air is probably the main cause of this increased risk. It is still unclear whether the asthma seen in these individuals has the same morphological pattern as the asthma seen in non-athletes. However, the findings of increased bronchial hyper-responsiveness parallel with asthma symptoms, advocates the assumption of airway inflammation in both sets of individuals. Treatment should be directed toward the decrease of known trigger or risk factors with training restrictions in low temperatures. Furthermore, athletes should avoid training in connection with recent respiratory tract infections. A careful warm-up of sufficient duration, preferably combined with heat exchange equipment, helps reduce the symptoms.

Until we acquire more information on the pathophysiological mechanisms involved in these defined settings, the athletes with asthma problems should be medically treated in accordance with the tradition established for all asthmatics. To date, there is no evidence that asthma medication, including long-acting β_2-agonist treatment, could enhance performance in healthy non-asthmatic athletes, in spite of the IOC doping rules.

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